Chapter 8: Ground Water

Groundwater

The WDNR has statutory authority to protect, maintain, and improve groundwater within the state. WDNR establishes the groundwater quality standards for the state, monitors groundwater quality, identifies and addresses groundwater quality problems and makes recommendations for preventing contamination. The Groundwater Section within WDNR's Bureau of Drinking Water and Groundwater takes a leading role in these activities. The Groundwater Section also works closely with the Groundwater Coordinating Council (GCC) to insure coordination between state agencies with groundwater protection responsibilities.

Wisconsin's Groundwater Law

Wisconsin recently enacted a Groundwater Quantity Management Law that will allow the WDNR to issue permits for high capacity wells. The law is considered a "first step" toward managing Wisconsin's groundwater quantity. Initially, the following steps will be taken to implement the law:

- Owners of new wells will notify the DNR of the well's location and pay a fee prior to construction;
- DNR will complete a limited number of well applications for wells in sensitive areas;
- Reporting requirements for high capacity wells will be expanded;
- Private well construction surveillance and inspection will be expanded by 2%; and
- A groundwater advisory committee will be established. The Groundwater Quantity Committee will be made up of representatives from government, private industry, agriculture, environmental interests and municipal water purveyors.

Two groundwater management areas are identified in the new legislation: the Fox River Valley and Southeastern Wisconsin. Groundwater levels in these two areas have declined significantly in the past 50 years.

Wisconsin's groundwater quality is protected under Act 410, which is the basis for Wisconsin's legal, organizational and financial capacity for controlling groundwater pollution. Under Act 410, Wisconsin developed Chapter 160 Wisconsin Statues. Under Chapter 160, Wis. Stats., the WDNR must establish state groundwater quality standards based on recommendations from the Department of Health and Family Services (DHFS). Setting standards is a continuous process. As substances are determined to be a threat to groundwater or if they are detected in groundwater, they are placed on a priority list established by WDNR in conjunctions with other state agencies. The numerical standards are in chapter 140, Wis. Adm. code. For each substance there is an enforcement standard (ES) which determines when a violation has occurred and a preventive action limit (PAL) which serves as a trigger for possible early remedial actions.

Once groundwater standards are set, all state agencies must manage their regulatory programs to comply. Each state agency involved in activities that affect groundwater must promulgate rules to assure that the groundwater standards are met and to require appropriated responses when standards are not met. The role of each agency in implementing the groundwater standards is described below under "Wisconsin Groundwater Programs."

The Groundwater Coordinating Council

The responsibility for managing Wisconsin's groundwater is delegated to many different government agencies. The Groundwater Coordinating Council (GCC) facilitates cooperation between the different agencies on non-regulatory issues. Since 1984, The GCC has served as a model for interagency cooperation among state government official, the governor, and local and federal governments. The WDNR chairs this council.

Senior-level representatives from the departments of Natural Resources; Commerce; Agriculture, Trade and Consumer Protection; Health and Family Services; Transportation; the University of

Wisconsin System; Wisconsin Geological and Natural History Survey and governor's office serve on the council. The GCC advises and assists state agencies in the coordination of nonregulatory programs and the exchange of information related to groundwater.

Department of Natural Resources

The WDNR is the designated state agency to protect, maintain and improve groundwater within the state. The Bureau of Drinking Water and Groundwater regulates public water systems and private drinking water supply wells. The groundwater section assists in coordinating groundwater activities of the WDNR as well as other state agencies. The groundwater section has primary responsibility for adoption of groundwater standards contained in chapter NR 140, Wis. Adm. code. Other duties of the Groundwater Section include: development of the annual groundwater monitoring plan; coordination of the joint solicitation for groundwater related monitoring and research proposals; review and management of groundwater monitoring projects; integration of groundwater in basin reports and watershed plans; the Source Water Assessment and Wellhead Protection Programs, and maintenance of a data management system for groundwater data.

Source Water Assessment Program

The 1996 Amendments to the Safe Drinking Water Act require states to have an USEPA-approved Source Water Assessment Program (SWAP). The purpose of the program is to protect public health by providing information that can be used to prevent contamination of public water supplies. Other benefits include: preserving water resources for future generations; avoiding the expense of cleaning up a contaminated water supply or finding alternative sources of water; reducing system costs by providing the information needed to apply for a waiver from specific monitoring requirements; and encouraging economic growth by assuring an abundant supply of clean water.

Wisconsin is currently in its fifth year in implementing its SWAP. Assessments for each public water supply include: 1) delineation of source water area boundaries; 2) inventory of significant potential sources of contamination within those boundaries; 3) determination of susceptibility for each system; and 4) release of the assessment results to the public water supplier and to the public. Assessments must be completed for both groundwater and surface water systems. Wisconsin has until December 30, 2004 to complete all source water assessments.

Source water assessments for the drinking water systems using surface water have been completed and are available on the Internet at: http://www.WDNR.state.wi.us/org/water/dwg/swap/index.htm. These systems provide drinking water to 1.5 million people in communities along Lakes Michigan, Superior and Winnebago. Surface water source water areas are shown below. Source water assessments for drinking water systems using groundwater are in various stages of completion. Assessments for municipal systems were completed in 2003 and are being hand-delivered to system operators. All public water supply system assessments will be completed in 2004. Brief summaries of all the completed assessments can be found at the Internet address above.

The Bureau of Waste Management regulates and monitors groundwater at proposed and active solid waste facilities and landfills. The Bureau for Remediation and Redevelopment oversees clean-up actions at spills , hazardous substance release sites, abandoned container site, state funded responses, Brownfields, "high priority" leaking underground storage tanks, closed wastewater and solid waste facilities, dry cleaner sites, hazardous waste corrective action and generator closures and sediment clean-up actions. The program runs the Dry Cleaner Reimbursement program and helps turn the Brownfield Site Assessment Grant program. Remediation and Redevelopment is also responsible for the Geographic Information System (GIS) registry of closed Remediation sites. This database is available on the Internet and includes information on site location and remaining residual groundwater contamination above the NR 140 ES. Department of Natural Resources Manual Code 4822.1 instructs staff on coordination of groundwater contamination investigations and regulated monitoring of potable wells.

The Bureau of Watershed Management regulates the discharge of municipal and industrial wastewater, by-product solids and sludge disposal from wastewater treatment systems and wastewater land treatment/disposal systems. The Bureau also issues WPDES permits for discharges

associated with clean-up sites, regulated under the authority of the Bureau for Remediation and Redevelopment. The Bureau has primary responsibility for regulating stormwater and agricultural runoff as well as managing waste from large animal feeding operations.

Department of Agriculture, Trade and Consumer Protection

The Department of Agriculture, Trade and Consumer Protection (DATCP) manages pesticides and pesticide practices to assure that established groundwater standards for these contaminants are not exceeded. This may include prohibition of certain activities including pesticide use. The agency also manages practices to "minimize" groundwater contamination to the extent "technically and economically feasible." DATCP regulates storage, handling, use and disposal of pesticides and the storage of bulk quantities of fertilizer. DATCP is also responsible for coordinating the development of Wisconsin's "generic" and "pesticide specific" state pesticide management plans for protection groundwater from pesticides.

In 1993 the Agricultural Chemical Cleanup Program (ACCP) was established to address point sources of pesticide contamination the ACCP reimburses responsible parties for cleanup costs related to pesticide and fertilizer contamination at facilities and in nearby wells. The ACCP also funds DATCP oversight of pesticide and fertilizer cleanup activities.

The Land and Water Resource management program provides funding primarily to counties to assist in protection of groundwater resources. Some of this funding is dedicated to the development and implementation of improved nutrient and pest management practices.

DATPC funds the Agricultural Clean Sweep program which helps farmers dispose of unwanted pesticides, farm chemical and empty pesticide containers.

Department of Commerce

The Department of Commerce enforces private on-site wastewater treatment system rules and the plumbing code. The Department is also responsible for regulating storage tanks containing flammable, combustible liquid and hazardous substances. Since 1991 the data base inventory of petroleum product tanks regulated by Commerce has increased from 143,681 to 174,725. Commerce is responsible for the Petroleum Environmental Cleanup Fund Act (PECFA) which cleanup at leaking underground storage tak sites. Since its inception, PECFA has reimbursed petroleum storage tank system owners approximately $1.05 billion to remediate petroleum contamination in soil and groundwater. Commerce and WDNR administer the Brownfields Sites Assessment Grant program for property owners.

Department of Health and Family Services

Chapter 160, Wis. Stats., directs the Department of Health and Family Services (DHFS) to recommend health-based enforcement standards for substances found in groundwater. DHFS staff provide information on health risks posed by drinking water contaminants, and investigate suspected cases of water-borne illness. The agency has been active in determining the extent, health effects and providing information to the public on naturally occurring arsenic in Winnebago, Shawano, Outagamie and Brown Counties.

Wisconsin Geological and Natural History Survey

The Wisconsin Geological and Natural History Survey (WGNHS) performs basic and applied groundwater research and provides technical assistance, maps and other information and education to aid in management of groundwater resources. The WGNHS groundwater program is complemented by geology and soils programs that provide maps and research based information essential to the understanding of groundwater recharge, occurrence, quality and movement.

Department of Transportation

The Department of Transportation (DOT) regulates the storage of highway salt to prevent groundwater contamination by dissolved chloride. DOT is also responsible for potable well sampling at 29 rest areas and 113 waysides. Other DOT groundwater related activities include road salt

research, hazardous material and waste investigation or remediation, wetland compensation and research, and stormwater management and research.

University of Wisconsin System

The University of Wisconsin system (UWS) has research, teaching and information/education responsibilities. These three missions are integrated through cooperation and joint appointments of teaching, research and extension personnel who work on groundwater issues.

Wisconsin's Groundwater Monitoring Program

Wisconsin is drafting a new statewide groundwater monitoring strategy. Representatives from the WDNR, DATCP, USGS, WGNHS and the Academy of Arts, Letters and Sciences looked at existing monitoring programs and monitoring needs that still need to be met. The objective of the new monitoring strategy is to coordinate groundwater monitoring between all state agencies that regulate groundwater to get a complete picture of groundwater quality and quantity in the state. The statewide groundwater monitoring strategy will meet the prerequisites of the Clean Water Act Section 106(e)(1) as described in the EPA's "Elements of a State Water Monitoring and Assessment Programs" guidance document. Specific goals include:

- Documenting status and trends in groundwater quality, quantity and use;
- Improving of understanding of groundwater systems and groundwater/surface water interactions; and
- Improving communication of groundwater information to citizens, policy makers and resource managers.

The components of the groundwater monitoring strategy include:

- A summary of existing groundwater monitoring data to better identify what data is currently available and where gaps in our knowledge are;
- A fixed network of monitoring locations to be used by all agencies to answer groundwater quality and quantity questions;
- Groundwater quality sampling data in areas of concern;
- Stream flow monitoring stations in areas important to groundwater systems;
- Water use reporting data to improve optimization of groundwater resources;
- Data management mechanism; and
- Informational materials to communicate the state of groundwater in Wisconsin to citizens.

As funding becomes available to implement the components of the strategy, they will be integrated into WDNR's yearly monitoring plan. The GCC will take the lead role in data management while other agencies will continue to make improvements in their monitoring efforts based on the comprehensive strategy. The components of the strategy may change over time according to needs of the different agencies. The requirements of Chapter 160, Wis. Stats., will continue to be met under the strategy.

Groundwater Quality

Groundwater quality varies greatly throughout Wisconsin. Human-made contaminants of concern are Volatile Organic Chemicals (VOCs), nitrates, and pesticides. Iron, manganese, sulfate, arsenic and radium are naturally occurring groundwater contaminants that present health concerns and are present in Wisconsin groundwater. Microbial contaminants including viruses, bacteria, and parasites are also a concern. To address specific concerns the GCC selects research projects as part of joint solicitation process. DNR funded projects are listed below.

Nitrates

Nitrate-nitrogen is the most commonly found groundwater contaminant in Wisconsin. Of 10,112 private wells sampled in the state since 1991, 20 % exceeded the ES and 50% exceeded the PAL. The majority of these wells are located in agricultural areas. Arsenic

Naturally occurring arsenic in Wisconsin groundwater has become an important issue since it was

first detected in 1987. The problem is especially prevalent in Outagamie, Shawano, Winnebago and Brown counties. In 2001, well sampling occurred in 15 townships in these counties. This data has not been evaluated yet, however, in two of the townships, almost 50% of the samples exceeded 5 ppb while 21.8% exceeded 10 ppb. In 2000, 3,300 public water supply systems were sampled for arsenic. Results show that 80 of these exceeded the proposed 10 ppb standard.

Radioactive Compounds

Two studies have been initiated by the WDNR to evaluate radioactive compounds in groundwater. In 2000, WDNR staff collected samples from 100 community and nontransient noncommunity public water supply wells which will be analyzed for total Uranium alpha activity, total Thorium alpha activity, Radium 226 and Polonium 210 alpha activities. Preliminary results indicate total Uranium is the major contributor to high gross alpha activities. A second study is looking at radon in drinking water supplies. WDNR staff will sample 340 noncommunity, nontransient and other than municipal water systems per year. Project results will determine the impact of new EPA standards for radon in drinking water. Preliminary results tend to support earlier findings that indicate approximately 50% of public water systems monitored in Wisconsin exceed the proposed radon standard of 300 pCi/L.

Joint Solicitation Projects

Continuing Projects:

Arsenic Contamination in Southeast Wisconsin: Sources of Arsenic and Mechanisms of Arsenic Release Jean Bahr and Madeline Gotkowitz, University of Wisconsin - Madison and Wisconsin Geological and Natural History Survey, Project #174.

New Projects:

Monitoring and predictive modeling of subdivision impacts on groundwater in Wisconsin Ken Bradbury and Jean Bahr, University of Wisconsin-Extension, Geological and Natural History Survey and Jean Bahr, University of Wisconsin - Madison, Project #178.

Field and Laboratory Validation of Photoactivated Adsorption for Removal of Arsenic in Groundwaters M. Anderson, University of Wisconsin-Madison, Project #179.

Development of a groundwater flow model for the Mukwonago River watershed, southeastern Wisconsin Jean Bahr, University of Wisconsin - Madison, Project #180.

Groundwater Pollutant Transfer and Export in Northern Mississippi Loess Hills Watersheds George Kraft and Bryant Browne, University of Wisconsin - Stevens Point, Project #181.

Future Groundwater Protection

Below are some of the priorities set by the Groundwater Coordinating Council for 2004.

- Investigation of adverse impacts from groundwater withdrawals: In FY 97, DNR staff with help from the Groundwater Quantity Technical Advisory Committee, completed a report on the groundwater quantity issue (see “Condition of the Resource - Groundwater Quantity” for the Executive Summary of this report). In the report, localized areas with groundwater quantity problems are identified and the effects of groundwater withdrawals on surface waters and long-term groundwater availability are discussed. There is a need to further quantify hydrographic relationships of surface and groundwater. The GCC should continue to encourage research efforts that will provide information useful in addressing this issue.

- Investigation of recently discovered groundwater contaminants: Recent research conducted in Europe and the U.S. indicates that traces of pharmaceuticals (including antibiotics and hormones) and pesticide breakdown products are common contaminants found in groundwater and surface water. Current testing methods do not allow adequate detection of these possible contaminants. Research is needed to determine whether these substances pose a threat to Wisconsin’s groundwater resource. There is also a need to evaluate the sources, fate, transport, and chemistry of p-

Isopropylbenzene (cumene), aluminum, molybdenum and strontium (non-radioactive form) in groundwater; evaluate existing databases; and sample at-risk potable wells for these contaminants.

- Investigation of naturally occurring substances in groundwater: Continued problems of elevated arsenic, low pH, and other water quality problems in domestic wells exist over large areas of northeast Wisconsin. DNR needs more information about the extent and causes of these problems in order to give advice to homeowners and well drilling contractors. Additionally elevated sulfate and total dissolved solids have been found in some new deep municipal wells in the Lower Fox River Valley making the wells unusable. In some other existing deep wells as far south as Milwaukee the total dissolved solids have been steadily increasing over the years. These sulfate and TDS levels pose a problem for local water managers, and the origin of the dissolved solids is not completely understood.

- Provide resources to local governments for Smart Growth/Comprehensive Planning activities. Recent legislation has required local units of government to develop a comprehensive plan by 2010 in order to undertake land use activities. This plan must address 9 elements, including natural and agricultural resources, housing, utilities, and land use. This planning process presents a unique opportunity to address and implement groundwater protection at the local level. The GCC will seek ways to assist local communities in their planning efforts to encourage groundwater protection.

- Promote consistency between the agencies on data management issues: Through updates to the DNR's groundwater data system and the Directory of Groundwater Databases, state and local government agencies now have more convenient access to groundwater data. This effort must be maintained by continuing to identify what data needs exist and ways to make data easily accessible. Data consistency must be promoted by use of translatable geolocational coordinate systems and consistent data elements for use in a GIS environment. The GCC will continue to provide leadership and communication on data management through its subcommittees. This continued effort displays the GCC's commitment to management of the resource through sound scientific methods.

- To act as a coordinating and facilitating mechanism for the publication and distribution of information and educational materials on groundwater related issues: The public has benefited from the consistent educational messages that have been endorsed by the Education Subcommittee. The Education Subcommittee will continue to provide its leadership and assistance to state agencies providing educational materials to the public. Priorities for the future include promoting water stewardship, awareness of water quantity issues, and providing materials for local communities to assist in their comprehensive planning activities.

- Distribution of findings from groundwater research or monitoring projects: There has been considerable progress in preparing summaries of the results of groundwater-related monitoring and research projects funded through the joint solicitation process. More than 90 of these summaries are now available on the UW-WRI web site maintained by UW-WRI. The rate of response to the web site posting of research findings has been very encouraging so far. To maintain and enhance this response it will be important to add new summaries annually as they become available, create a more visually appealing set of front-end pages for the site, and publicize the web site location and content more widely. More work needs to be done to target interested audiences and distribute summaries and final reports more widely.

- Identify tools that can be used to better predict Wisconsin's groundwater susceptibility to contamination: Studies have demonstrated the need for developing statewide data layers that would facilitate better groundwater vulnerability assessments. These data layers include land use, soils, regional groundwater flow, hydrogeologic characteristics such as aquifer materials, and potential point sources of contamination such as underground storage tanks and pesticide spills. The

studies also illustrate the importance of locational data for contaminant sources. The GCC's Planning & Mapping and Monitoring & Data Management Subcommittees have prioritized, promoted, and helped facilitate the development of data layers as part of a larger data integration initiative.

- Research on land use management and its impact on the groundwater resource: Additional research is needed on the effect of various land uses (e.g. urbanization) on groundwater quality and quantity. Several projects that study the impacts of land use on groundwater have been and continue to be funded through the joint solicitation. These projects must be managed in such a way as to maximize their relevance to state land use problems. This issue crosses agency lines and promises to be an important issue for years to come.

- Continued evaluation of alternatives to onsite sewage systems: Although the DNR and Commerce have funded monitoring projects in this area, additional work is needed to find state-of-the-art private sewage system technologies that provide efficient, cost-effective options and protect groundwater resources.

- Investigation of the causes and effects of nitrate in groundwater: The GCC will support the agencies and the UWS in obtaining information pertinent to the human health implications of consuming nitrate contaminated groundwater and the effect of discharge of this groundwater on surface waters and their ecosystems. In addition, it will continue to facilitate consistent education to provide a clear message on the many causes and effects of nitrate in groundwater for urban and rural citizens.

- Solutions to groundwater nonpoint pollution problems: A 1997 DATCP report indicates that 8.5% of Wisconsin's wells still contain detectable atrazine residues. In addition, 10% exceed the nitrate standard. These rates are substantially higher in agricultural areas. Agriculture is the major source of these pollutants. More work is needed to determine how far Wisconsin groundwater will deteriorate without a substantial change in farming practices, and what practices will sustain both agriculture and groundwater quality.
- Improved communication between local and state government: The Local Government Subcommittee to the GCC was created in February 1993 to provide a line of communication between local and state governmental entities. To increase the responsiveness of state agencies to local government needs, local government needs must be communicated to the GCC and relayed to the appropriate agencies. An effort must be made by the GCC to increase interest in the GCC by local governments, and to offer opportunities to communicate concerns to regulatory agencies.